REMARKS

The Office Action dated July 14, 2003 has been received and carefully studied.

The Examiner states that the status of the nonprovisional parent application referenced should be included. By the accompanying amendment, the specification has been amended to recite that the parent application is pending.

The Examiner acknowledges receipt and consideration of the IDS submitted on May 31, 2002, and also notes the third party submission that was filed. Applicants wish to point out that an IDS was submitted on June 17, 2003. Consideration thereof is respectfully requested.

The Examiner objects to the drawings due to a typographical error. By the accompanying amendment, the error has been corrected.

The Examiner also objects to the Abstract and to the disclosure due to certain informalities. By the accompanying amendment, the informalities have been corrected.

The Examiner provisionally rejects claims 1-2, 20-25, 33-35 and 40-41 under 35 U.S.C. §101 as claiming the same invention as claims 1-2, 5-10, 18-20 and 25-26 of co-pending application Serial No. 09/957602.

By the accompanying amendment, claim 1 has been amended to recite that the fibrous layer comprises a mixture of glass fibers and polymeric fibers, and to more clearly define the macroscopic openings. Support for the amendment can be found in original claim 13, and at page 6, first and second paragraphs of the specification, for example. It is believed that the amendment overcomes the provisional rejection.

The Examiner rejects claims 1, 13, 18-25, 34-35 and 40 under 35 U.S.C. §103(a) as being unpatentable over Aidman et al., U.S. Patent No. 5,376,477 in view of Van Sacken et al., U.S. Patent No. 5,747,188. The Examiner states that Aidman et al. disclose a battery plate separator system with three layers in face-to-face relationship, the first and third layers including a porous mat

of fibers, and a second layer between the first and third layers comprising a porous organic polymeric sheet with pores. Since Aidman et al. disclose that the separators are to be used in lead-acid batteries and are inert to the electrolyte, the Examiner considers that the layered separator system is acid-resistant. The Examiner admits that Aidman et al. do not expressly disclose that the pores are macroscopic or the specific diameter of the pores, and cites Van Sacken et al. for its disclosure of a battery separator wherein the outer separator section comprises a plurality of macroscopic holes greater than 1 μm. The Examiner concludes that it would have been obvious to make the separator of Aidman et al. with macroscopic holes in view of the teachings of Van Sacken et al.

Prior to the present invention, in spite of the many known advantageous properties of fibrous layers as a separator material, the use of fibrous layers was limited due to their severe mechanical weakness which was a problem in high speed processing applications. In order to overcome this problem, in the separators of the present invention, the fibrous layers are reinforced by means of at least one support layer providing mechanical strength. Accordingly, the separators as now claimed comprise at least one fibrous layer and at least one support layer comprising a plurality of macroscopic openings, i.e., openings having a diameter larger than 50 μm and penetrating the whole thickness of the layer.

Surprisingly, by providing the plurality of macroscopic openings, the support layer does not impair oxygen and ion transfer and therefore does not have a negative influence on the internal battery resistance. This is essential in order not to lose the advantageous properties provided by the fibrous layers. Therefore, the openings of the support layers are arranged to provide straight paths extending substantially perpendicularly to the extended plane of the layer to enable direct ionic transfer through the layer. To achieve these goals, the openings are macroscopic and in fact should have a large diameter to allow free passage of oxygen and ions.

Aidman et al. disclose a battery plate separator comprising three layers in face-to-face

relationship. The first and third layers comprise porous mats made of randomly oriented fibers made of glass and/or an organic polymeric material. The second layer is disposed between the first and third layers and comprises a porous organic polymeric sheet. Among other things, the second layer functions to block penetration of the separator by metallic particles. Accordingly, it comprises sufficiently small pores which are arranged to provide tortuous paths through the layers (see column 4, lines 12-16 and 46-50, as well as column 6, lines 6-9).

Therefore, the pores cannot be regarded as macroscopic openings in the sense of the present invention as claimed, which have a large diameter and which are not intended to block the passage of particles, but to the contrary, allow the passage of oxygen and ions. Aidman et al. thus expressly disclose pores which are not macroscopic openings.

Van Sacken et al. disclose a battery exhibiting improved safety behavior under conditions of application of increasing non-uniform pressure to the container of the battery. An active electrode assembly comprising a cathode electrode and an anode electrode is located within the container. The battery further comprises an inner separator disposed between the cathode electrode and the anode electrode and an outer separator disposed between the outer electrode and the inner wall of the container.

In one embodiment, the outer separator comprises a plurality of macroscopic holes having a diameter larger than 1 μm. These holes function as a means to generate an extrinsic internal short outside the active electrode assembly, i.e., inside the container and involving at most one electrode of the active electrode assembly, upon application of increasing non-uniform pressure to the container (see e.g., claim 1, feature (c)). For this purpose, the holes in the outer separator are arranged such that the container in the undeformed state does not contact the outer electrode but does so if deformed sufficiently (see e.g. column 8, lines 40-47). These means are provided because a short occurring (exclusively) inside the active electrode assembly, i.e., directly between the cathode electrode and the

anode electrode, is highly disadvantageous and should be avoided for safety reasons (see e.g. column 5, lines 19-28). For this reason, it is also evident that the inner separator does not comprise holes allowing a direct contact between the electrodes. This also follows from the fact that any separator should prevent passage of particles which might generate a short. Accordingly, one skilled in the art would not be motivated to modify the separator of Aidman et al. in view of Van Sacken et al.

In contrast to the present invention, Van Sacken et al. do not disclose a separator comprising at least one fibrous layer and at least one support layer. Rather, the separators of Van Sacken et al. only include one microporous polymer layer, and the separator disposed between the electrodes does not include macroscopic openings in the sense of the present invention.

Accordingly, even if one skilled in the art were somehow motivated to modify the separator of Aidman et al. in view of Van Sacken et al., the present invention as claimed would not be arrived at. Indeed, it would not have been obvious to provide the second layer of the separator according to Aidman et al. with the plurality of macroscopic holes shown in the outer separator according to Van Sacken et al.

The separator of Aidman et al. is disposed between two electrodes of opposite polarity and, among other things, serves to prevent passage of particles which could lead to the generation of a short. Therefore, providing the second layer of this separator with macroscopic holes would not provide an extrinsic internal shorting means of the battery. In most cases, the outer fibrous layers disposed adjacent to the electrodes would still prevent the occurrence of a short. If at all, such holes would only increase the possibility of a direct contact between the electrodes upon deformation of the container, i.e., occurrence of a condition to be avoided for safety reasons according to Van Sacken et al. Improved safety behavior cannot be achieved by providing macroscopic holes in the second layer of the separator of Aidman et al.

Moreover, a combination of the teachings of Aidman et al. and Van Sacken et al. also would

not have been obvious with regard to an outer separator in the sense of Van Sacken et al., because the first and second fibrous layers would again prevent the desired short from occurring.

In summary, Van Sacken et al. seeks to create a short which is neither obvious nor advantageous for a separator disposed between electrodes of opposite polarity such as the separator of Aidman et al.

The Examiner also rejects claim 2 under 35 U.S.C. §103(a) as being unpatentable over Aidman et al. in view of Van Sacken et al. and further in view of Okada et al., claims 14-17 as being unpatentable over Aidman et al. in view of Van Sacken et al. and further in view of Waterhouse, and claims 33 and 41 as being unpatentable over Aidman et al. in view of Van Sacken et al. and further in view of Fraser-Bell et al.

None of the secondary references supply the deficiencies of the combination of Aidman et al. and Van Sacken et al. articulated above. Accordingly, these claims are believed to be allowable by virtue of their dependence.

Reconsideration and allowance are respectfully requested in view of the foregoing.

Respectfully submitted,

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